

XV. THE INDIAN MOLLUSCS OF THE  
ESTUARINE SUBFAMILY  
STENOTHYRINAE.

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(Plate XVI).

Among the estuarine Gastropods of the coasts of India, Malaysia and China few are commoner and more characteristic, but smaller and less conspicuous, than the Hydrobiidae of the subfamily Stenothyriinae. These little water-snails, the shell of which is rarely more than 5 mm. long, are found mainly in brackish water. A few make their way far inland, but it is doubtful whether any species<sup>1</sup> exists only in fresh water. The species seem to be fairly numerous and individuals are often abundant. Their habits are very uniform. They frequent submerged vegetation or stones covered with algae and scrape therefrom the minute organisms that form their food. Their mobile and extensile snouts enable them also to feed easily on the algae that grow on the shells of their companions and even on their own. The eggs are sessile, relatively large and few. Some species are markedly gregarious. In eastern waters they apparently replace the Hydrobiinae of the western parts of the Palaearctic Region.

Subfamily STENOTHYRINAE.

1887. Stenothyriinae, Fischer, *Man. Conchyliol.*, p. 724.

Fischer includes in this subfamily of the Hydrobiidae two fossil genera (*Briartia* and *Nystia*) as well as the living *Stenothyra*. His description is short and he does not appear to have been acquainted with some of the most characteristic features of the shell or the animal. The subfamily, however, is well differentiated from both the Bithyniinae and the Hydrobiinae and has no particular resemblance to the Mysorellinae. It may be redefined as follows:—

SHELL minute, ovate or subcylindrical, compressed in its dorso-ventral axis; the aperture small, oblique or transverse, oval or subcircular, with a complete and uniform peristome, which is never very prominent or in-crasate. The surface smooth, rarely ornamented with periostracal spines, more commonly with minute punctures arranged in spiral lines.

OPERCULUM horny but containing a considerable amount of calcareous matter, paucispiral externally, with two prominent transverse ridges on the internal surface.

<sup>1</sup> *S. foveolata*, Benson, is only known from Sikrigalli, a distance of 300 miles from the sea and about 200 miles above the extreme tidal influence, but the species may occur lower down as well in the Gangetic Delta.

RADULA as in the Bithyniinae but with the teeth relatively broader and the laterals and marginals less differentiated, baso-lateral denticulations present on the centrals.

SOFT PARTS. Foot long and narrow when expanded, *spindle-shaped*, pointed or produced behind, with the antero-lateral angles produced and the anterior margin excavate or truncate. *Snout cylindrical, extremely mobile and extensile*. Tentacles filiform, bearing the eyes on slight prominences at their base. *Penis without a lateral process*.

The statements in italics in this description serve to differentiate the subfamily. The small size of the shells causes them to resemble those of the genus *Hydrobia* (*Paludestrina*) superficially, but their peculiar compressed form is most characteristic, while the structure of the operculum and that of the central tooth of the radula are different. With the Bithyniinae they agree in the structure of the radula but not in other characters.

The position of the subfamily, at least so far as the genus *Stenothyra* is concerned, may now be discussed. Benson<sup>1</sup> in describing the genus did not assign it to any family or subfamily. Woodward<sup>2</sup> included it amongst the Littorinidae as a subgenus of *Rissoa*. Gray<sup>3</sup> followed Woodward in retaining *Nematura* in the Littorinidae but differed from him in giving it a generic rank. Adams<sup>4</sup> placed it among the Viviparidae and the same course was adopted by von Frauentfeld.<sup>5</sup> Troschel<sup>6</sup> who still designated the genus as *Nematura* placed it with *Bythinia* in his group Bythiniinae. Stimpson<sup>7</sup> recognised its exact position more nearly, but guided by both the shell and radular characters placed it in the subfamily Hydrobiinae. Clessin,<sup>8</sup> after discussing the courses adopted by previous authors, separated the subfamily Bythiniinae from the Hydrobiinae, both of which he included in the family Rissoidae, and placed the genus *Stenothyra* in the subfamily Bythiniinae. Nevill,<sup>9</sup> following Adams and von Frauentfeld, assigned it to the family Viviparidae or what he called the Paludinidae, while as to its subfamily rank he agreed with Stimpson in including it amongst the Bythiniinae. Fischer<sup>10</sup> as already stated separated *Stenothyra* with two fossil genera into a new subfamily of the Hydrobiidae—*Stenothyrinae*. Heude<sup>11</sup> placed the Chinese *Stenothyra* amongst the Bithyniidae. The species from the Dutch East Indies were assigned by von Martens<sup>12</sup> to the family Paludinidae, but nothing was said as to their subfamily rank. Fischer and Dautzenberg<sup>13</sup>

<sup>1</sup> Benson, *Journ. As. Soc. Bengal*, V, p. 782 (1836), and *Ann. Mag. Nat. Hist.* XVIII, p. 496 (1856).

<sup>2</sup> Woodward, *Manual of Mollusca*, p. 137 (1851—1856).

<sup>3</sup> Gray, *Guide Syst. Dist. Moll. Brit. Mus.* I, p. 99 (1857).

<sup>4</sup> Adams, H. and A., *Genera of Recent Mollusca* I, p. 342 as *Nematura* (1858).

<sup>5</sup> von Frauentfeld, *Verh. Zool.-bot. ges. Wien*, XII, pp. 1157, 1158 (1862).

<sup>6</sup> Troschel, *Gebiss der Schnecken* I, p. 104 (1856—1863).

<sup>7</sup> Stimpson, *Smithsonian Misc. Pub.* No. 201, p. 40 (1865).

<sup>8</sup> Clessin, *Malakozool. Blatt.* n. s. II, p. 193 (1880).

<sup>9</sup> Nevill, *Hand-List Moll. Ind. Mus.* II, p. 42 (1885).

<sup>10</sup> Fischer, *Man. Conchylol.* p. 724 (1887).

<sup>11</sup> Heude, *Mem. Hist. Nat. Chinois* I, p. 173 (1880—1890).

<sup>12</sup> von Martens, *Suss-und Brackw.-Moll.* in *Zool. Ergeb. Nieder. Ost. Indien* IV, p. 210 (1897).

<sup>13</sup> Fischer and Dautzenberg, *Mission Pavie Indo-China*, p. 420 (1904).

included it in the family Hydrobiidae. Preston<sup>1</sup> followed Fischer in keeping Stenothyridae as a subfamily of Paludetrinidae (=Hydrobiidae). We have already given our reasons for following Fischer.

The position of the fossil shells assigned to the subfamily by Fischer is doubtful. The Indian, Chinese and Malaysian species we have examined belong to the single genus *Stenothyra*, Benson, which seems to be divisible into two subgenera, which we call *Stenothyra* (s.s.) and *Astenothyra* nov.

The subgenera may be distinguished on shell-characters<sup>2</sup> as follows:—

1. Ventral surface of body-whorl flattened; mouth very small, not at all prominent, separated from the outer edge of the shell above by a well-defined triangular area ... .. *Stenothyra*.
2. Ventral surface of body-whorl convex; mouth larger and slightly prominent, less regular in outline; area separating it from the edge of the shell small and ill-defined ... .. *Astenothyra*.

### Genus *Stenothyra*, Benson.

*The shell* is small, rarely<sup>3</sup> exceeding 5 mm. in length, but relatively thick, ovate or subcylindrical, distinctly compressed in the dorso-ventral axis, with at least 4 whorls, without prominent sculpture. The umbilicus is closed or rimate. The aperture is relatively broad, ovate, oval or subcircular, oblique or transverse. The peristome is continuous and uniform, never prominent and barely thickened. The periostracum is well developed.

*The operculum* is horny, but thick and containing much calcareous matter, very brittle, paucispiral on the external surface. The internal surface is somewhat convex, smooth and polished with a thickened rim. On it are developed two short, prominent transverse ridges, situated nearer the upper and lower extremities than the centre. In the complete shell the operculum fits tightly into the mouth, but in periods of active growth it is retracted as far as the old peristome.

*The radula*.—The central tooth is broad and has an enlarged central cusp with much smaller lateral cusps on either side. It is produced into a lateral process on either side and each process bears a series of latero-basal denticulations. The outer teeth are also relatively broad and have their denticulations rather poorly developed. There is an enlarged central or internal cusp on the inner lateral.

<sup>1</sup> Preston, *Faun. Brit. Ind. Freshw. Moll.* p. 79 (1915).

<sup>2</sup> In differentiating shells of this subfamily (and, indeed, those of all Hydrobiidae) it is important that fully formed specimens should be selected. Those collected in periods of active growth have the peristome incomplete. The operculum, moreover, can be retracted as far as the old mouth and has its margin distinctly ciliate.

<sup>3</sup> The shells of the Bornean species *S. strigilata*, Benson, measure as much as 8 mm. in length.

*The soft parts.*—The foot is long and narrow, fusiform as a whole but with the antero-lateral angles produced. The posterior extremity is pointed or produced into a filament. The central region of the sole is somewhat dilated, the dilation corresponding with the position of the operculum on the upper surface. The snout is long and cylindrical, extremely mobile and extensible. The tentacles are filamentous and have the eyes situated on slight prominences at their base. The male organ, which is situated on the “neck,” lacks a lateral appendage.

#### Subgenus *Stenothyra*, s.s.

1836. *Nematura*, Benson, *Journ. As. Soc. Bengal* V, p. 781.  
 1856. *Stenothyra*, Benson, *Ann. Mag. Nat. Hist.* ser 2, XVII, p. 496.  
 1857. *Nematura*, Gray, *Guide Syst. Dist. Moll. Brit. Mus.* 1, p. 90.  
 1858. *Nematura*, Adams, H. and A., *Genera Rec. Moll.* 1, p. 342.  
 1858. *Stenothyra*, *ib.*, *id.*, 11, p. 626.  
 1862. *Nematura*, von Fraunfeld, *Verh. Zool.-bot. ges. Wien* XII, pp. 1157, 1158.  
 1865. *Stenothyra*, Stimpson, *Smithsonian Misc. Pub.* No. 201, p. 40.  
 1885. *Stenothyra*, Nevill, *Hand-List Moll. Ind. Mus.* 11, p. 42.  
 1887. *Stenothyra*, Fischer, *Man. Conchyliol.*, p. 731.  
 1915. *Stenothyra*, Preston, *Faun. Brit. Ind. Freshw. Moll.*, p. 79.

The body-whorl of the shell is distinctly flattened on the ventral surface and the aperture is relatively small and not at all prominent, the peristome being not at all or only slightly thickened or dilated and of regular subcircular or oval outline. The upper and outer region of the mouth is separated from the outer edge of the whorl by a well-defined *boss* or triangular area that is usually more or less tumid. The periostracum is relatively thin and, except for the frequent occurrence of punctured lines and of the horny spines in some species, smooth. The operculum is oval or subcircular. The radula has the generic characters well developed. The foot is produced into a filament behind.

*Type-species.*—*Stenothyra deltae* (Benson).

The species of this subgenus have hitherto stood in need of revision, and in recent years several quite unnecessary names have been set up by Preston. The number actually known from the coasts of India have, therefore, proved, as Annandale and Kemp suggested,<sup>1</sup> smaller than had been supposed, but we have to describe several hitherto undescribed forms.

We can now recognise 12 Indian species but are doubtful about the Burmese species described as *Nematura puncticulata* by Gould.<sup>2</sup> Of these species we have examined the types in most cases and authentic specimens in others. The Indian species, with the exception of Gould's *Nematura puncticulata*, which we are unable to recognise, may be distinguished by the help of the following key:—

<sup>1</sup> Annandale and Kemp, *Mem. Ind. Mus.* V, p. 345 (1916).

<sup>2</sup> Gould, *Proc. Boston Nat. Hist. Soc.* 11, p. 220 (1847).

1. Shell bearing a spiral row of large spines on some of the whorls in addition to the microscopic sculpture.
  - A. Spines restricted to basal whorls of the spire only; the whorls evenly inflated and not keeled ... *S. echinata*.
  - B. Spines present on almost all the whorls including the body-whorl; the whorls especially those of the spire ridged or keeled in the middle ... *S. ornata*.
- II. Shell without any definite spines, with or without a definite spiral sculpture.
  - A. Shell elongate-ovate, nearly cylindrical.
    - I. Shell rather small and narrow ( $2\frac{1}{2} \times 1\frac{1}{4}$  mm.); sub-perforate, rimate; with the whorls of the spire increasing regularly and having a microscopic sculpture ... *S. hungerfordi* [ana.]
    - II. Shell much larger ( $4\frac{1}{2} \times 3$  mm.), imperforate; with the whorls of the spire increasing irregularly and with relatively large pits on the surface of the shell ... *S. monilifera*.
  - B. Shell ovate or ovoid never elongate cylindrical.
    - I. Mouth opening large, more than  $\frac{1}{3}$  the size of the body-whorl.
      - A. Body-whorl not at all flattened on the ventral surface, and with a very small boss separating the mouth from the body-whorl ... *S. soluta*.
      - B. Body-whorl distinctly flattened on the ventral surface, at least in its anterior half, and with a well-developed boss separating the mouth from the body-whorl.
        1. Shell small (1.4 mm. long), with a very short spire and with a well-developed boss above an elongate circular mouth ... *S. atomus*.
        2. Shell large, over 3 mm. long, subventricose-ovate, with a short spire, the whorls of the spire increasing irregularly; a greatly swollen body-whorl and a biangulate suboval mouth ... *S. blanfordiana*.
        3. Shell large, 3 mm. long, elongate-ovate; the spire more produced, with regularly increasing whorls; body-whorl less tumid and the mouth nearly circular or having only a faint notch above ... *S. minima*.
    - II. Mouth-opening small, less than  $\frac{1}{3}$  the size of the body-whorl.
      - A. Shell without any spiral pitted sculpture ... *S. woodmasoni* [ana.]
      - B. Shell with a definite spiral pitted sculpture.
        1. Shell minute, 2.2 mm. long, with a very short spire and a bluntly rounded apex ... *S. nana*.
        2. Shell relatively large, with a prominent conical spire and an acuminate apex.
          - a. Shell globose-conical, having a large and swollen body-whorl, and with a well-developed boss ... *S. deltae*.
          - b. Shell ovate, acute, having a smaller and not greatly swollen body-whorl, and with a much smaller boss ... *S. foveolata*.

**Stenothyra echinata**, Annandale and Prashad.

1919. *Stenothyra echinata*, Annandale and Prashad, *Rec. Ind. Mus.* XVI, p. 247, pl. xx, fig. 5.

*S. echinata*, as was noted in the original description of the species, is closely allied to *S. deltae* (Benson), which also shows traces of spines in some specimens, but is easily distinguished by

its much smaller size, narrower and less inflated body-whorl and the larger but relatively broader mouth.

***Stenothyra ornata*, sp. nov.**

Plate XVI, figs. 1, 2.

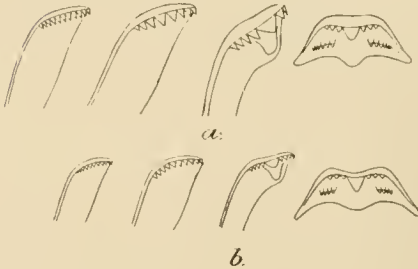
The shell in this species is relatively large, conoidal-ovate in form, and of a brownish colour. The apex is acutely pointed, and the shell has  $5\frac{1}{2}$  whorls. The suture is moderately impressed, somewhat oblique but irregular. The whorls of the spire are distinctly keeled in the middle and a continuation of the keel is to be made out on the body-whorl as well; they increase regularly in size but owing to their keeled nature do not appear to be very much swollen. The first two whorls are rather minute, the third is about as broad as the penultimate, which is somewhat band-shaped. The body-whorl, as seen from the dorsal side, is subquadrate, ventrally it appears to be somewhat ovoidal with the inverted apex sharply truncated. The mouth of the shell is very minute, oblique and regularly subcircular. The rim of the mouth does not project at all and the shell is not umbilicate. All the whorls are covered with a clayey deposit, but in some places show distinct vertical verniform striae of a darker colour. The last 4 whorls have a persistent spiral row of fairly large, blunt, flattened, horny spines in the region of the keel; the spines are directed towards the apex and are of a blackish colour.

*Measurements of type-shell (in millimetres).*

Length	..	..	..	..	5
Breadth of the body-whorl	..	..	..	..	3.2
Length of the spire (dorsal view)	..	..	..	..	2.7
Aperture	..	..	..	..	1.3

We figure the radular teeth.

*Type-specimen*.—No. M 11565/2 in the collections of the Zoological Survey of India (Indian Museum).



TEXT-FIG. 1.—Radular teeth of *Stenothyra*, Benson.

(a) *S. (S.) ornata*, sp. nov.  $\times 250$ .

(b) *S. (A.) miliacea* (Nevill)  $\times 500$ .

*Locality*.—Two shells of this species were collected by Dr. S. W. Kemp in a pool of brackish water at Dhappa near Calcutta.

*Remarks*.—The species is closely allied to *S. deliae* (Benson) and *S. echinata*, Annandale and Prashad, but is distinguished by the larger and more acute spire, the form of the body-whorl, the keeled

nature of the whorls, the sculpture and by the comparatively shorter and more circular mouth.

***Stenothyra hungerfordiana*, Nevill.**

1880. *Stenothyra hungerfordiana*, Nevill, *Journ. As. Soc. Bengal*, XLIX, pt. ii, pp. 159, 160.  
 1881. *Stenothyra hungerfordiana*, *ib.*, *id.*, L, p. 150, pl. vii, fig. 9.  
 1885. *Stenothyra hungerfordiana*, Nevill, *op. cit.*, II, p. 44.  
 1915. *Stenothyra hungerfordiana*, Preston, *op. cit.*, p. 80.

This interesting species was hitherto known from the original specimens collected in the Andaman Islands by the late Dr. F. Stoliczka and Rev. J. Warneford, but we have found another young specimen in the Indian Museum, also collected in the Andamans (precise locality and donor not stated), which had been wrongly labelled as *S. minima* (Sowerby). The types are preserved in the Indian Museum, but according to Nevill the species was also represented in the collections of Dohrn, Warneford, Theobald, Blanford and Hungerford.

Nevill's description of the species is excellent, and we have nothing to add to it. The distinguishing characters of the species are also well shown in the figure in his second paper cited above.

***Stenothyra monilifera*, Benson.**

1856. *Stenothyra monilifera*, Benson, *op. cit.*, p. 497.  
 1858. *Stenothyra monilifera*, Adams, H. and A., *op. cit.*, II, p. 626.  
 1862. *Nematura monilifera*, von Frauentfeld, *op. cit.*, XII, p. 1159.  
 1864. *Stenothyra monilifera*, Crosse and Fischer, *Journ. Conchyliol.* XII, p. 331.  
 1867. *Stenothyra monilifera*, Blanford, *Journ. As. Soc. Bengal* XXXVI, pt. ii, p. 58, pl. xiii, fig. 15.  
 1875. *Stenothyra monilifera*, Morelet, *Ser. Conchyliol.* IV, p. 314.  
 1876. *Stenothyra monilifera* (as *Nematura* in *Syst. Ind.*), Hanley and Theobald, *Conch. Ind.* p. 17, pl. xxxvii, fig. 4.  
 1876. *Stenothyra monilifera*, Theobald, *Cat. Land. and Freshw. Shells India*, p. 15.  
 1885. *Stenothyra monilifera*, Nevill, *op. cit.*, II, p. 44.  
 1915. *Stenothyra monilifera*, Preston, *op. cit.*, p. 80.

*S. monilifera* was described by Benson from specimens collected by the late Mr. W. Theobald at Mergui, Tenasserim. The same collector had also found specimens at Rangoon. Blanford obtained specimens at Port Dalhousie in the Bassein River, Burma. Crosse and Fischer recorded its occurrence in a marshy area in Cochin-China. In the Indian Museum collection the species is represented by specimens from Akyab, Amherst and Penang.

Benson's description of the species needs no amplification, while in Blanford's and Hanley and Theobald's figures the species is delineated very well.

Nevill doubtfully considered *S. puncticulata* (Gould) as being synonymous with this species; we discuss this at length in our remarks on that species (p. 133).

The species is closely allied to *S. hungerfordiana*, Nevill, but is distinguished by the shell being much larger, the shape of the body-whorl, the irregular increase of the whorls and the sculpture.

**Stenothyra soluta**, Annandale and Prashad.

1919 *Stenothyra soluta*, Annandale and Prashad, *Rec. Ind. Mus.* XVI, pp. 247, 248, fig. 3; pl. xx, fig. 6.

We have nothing to add to our recent account of the species beyond noting the intermediate character of the shell, so far as the form of mouth and the narrow boss are concerned, between the forms separated by us into the subgenera *Stenothyra*, s.s. and *Astenothyra*. *S. soluta*, however, has a closer relationship with other species of the subgenus *Stenothyra* than with any of the known forms of *Astenothyra*. Its existence prevents us from separating *Astenothyra* generically.

**Stenothyra atomus**, Nevill, MS. (Prashad).

Plate XVI, figs. 3, 4.

1885. *Stenothyra*, n. sp., Nevill, *op. cit.*, p. 45.

In the reference cited above Nevill referred to a single specimen from Arakan, Burma, in the collections of the Indian Museum, as a new species of *Stenothyra*. He called this species by the name *S. atomus* on a label, but did not publish any description or figure of it. I describe it here under Nevill's manuscript name.

The shell of this species is very small, thick, and in the single specimen bleached white. It is of a regularly ovoid form with the body-whorl only slightly flattened ventrally in its anterior half. The apex is obtuse and there are  $4\frac{1}{2}$  whorls. The suture is moderately impressed, but much less so dorsally than ventrally. The whorls of the spire increase rapidly and irregularly; the first whorl is very minute, the second is fairly prominent but narrow, while the penultimate whorl is much larger, band-shaped and moderately inflated. The body-whorl is large but rather narrow, in dorsal view it has a somewhat triangular outline owing to the outer border forming a continuous curve with the lower margin, the inner margin is also regularly curved; seen from the ventral side it appears somewhat pyriform. The mouth is subcircular or rather elongate-circular, with a thickened margin which, however, does not show any trace of being recurved. No sculpture can be made out in the unique type.

*Measurements of type-shell* (in millimetres).

Length .. .. .	..	1.4
Breadth of the body-whorl ..	..	.8
Length of the spire (dorsal view) ..	..	.65
Aperture .. .. .	..	.4

*Type-specimen*.—No. 2214 in the collections of the Zoological Survey of India (Indian Museum).

*Locality*.—The only specimen of this species we have seen is the unique type from Arakan, Burma collected by the late Dr. F. Stoliczka.

*Remarks*.—The species, though allied to *S. minima*, is distinguished easily from the latter by the spire being very short and



ending in an obtuse apex, the boss being well developed, and by the mouth being nearly round.

### *Stenothyra blanfordiana*, Nevill.

1880. *Stenothyra blanfordiana*, Nevill, *op. cit.*, p. 160.  
 1881. *Stenothyra blanfordiana*, Nevill, *op. cit.*, p. 156, pl. vii, fig. 10.  
 1885. *Stenothyra blanfordiana*, Nevill, *op. cit.*, p. 45.  
 1907. *Bithinella canningensis*, Preston, *Ann. Mag. Nat. Hist.*, ser. 7, XIX, p. 216, fig. 6.  
 1914. *Stenothyra chilkaënsis* and *S. orissaënsis* (in part not the fig.), Preston, *Rec. Ind. Mus.* X, p. 300, fig. 4.  
 1915. *Stenothyra blanfordiana*, *S. chilkaënsis*, *S. orissaënsis* and *S. minima* (in part), Preston, *op. cit.*, pp. 81, 82.  
 1915. *Stenothyra obesula*, Preston, *Rec. Ind. Mus.* XI, pp. 292, 293, fig. 4.  
 1916. *Stenothyra blanfordiana*, *S. minima* and *S. orissaënsis* (in part), *S. chilkaënsis* and *S. obesula*, Annandale and Kemp, *Mem. Ind. Mus.* V, p. 349.

Nevill's description of the species is very concise and accurate, and the figure of the species published in his second paper, cited above, is a very good representation of the species. It is unfortunate, therefore, that Preston should have described specimens of this species from the type-locality—the Chilka Lake, under the new names *S. chilkaënsis* and *S. obesula*. The latter was based by him on a single specimen only. We have carefully compared Preston's types of his new species with Nevill's type of *S. blanfordiana* and many other specimens of the species in the Indian Museum, and can detect no constant differences. Preston further identified specimens of this species as *S. minima* and *S. orissaënsis*; the latter of which names is no more than a synonym of *S. minima*. As to *Bithinella canningensis*, we found on examination of the type-shell that it was a young shell of *S. blanfordiana*; as is one of the co-types. The rest of the series identified by Preston as *B. canningensis* consists of shells of the *forma typica* and var. *subangulata* of *S. (Astenothyra) miliacca*.

We have nothing to add to Nevill's original description beyond noting the near relationship of this species to *S. minima* (Sowerby), which also occurs in the Chilka Lake. The two are so closely allied that one is liable to mistake specimens of the one for those of the other, unless the shells are carefully examined under a fairly strong lens from both the dorsal and ventral sides. When so examined the regularly increasing whorls of the spire of *S. minima* at once mark it off from *S. blanfordiana*.

*S. blanfordiana* is known from the Chilka Lake, Madras, and Port Canning in the Gangetic Delta.

The types of *S. blanfordiana*, *S. obesula* and *S. chilkaënsis* are all preserved in the collections of the Zoological Survey of India (Indian Museum).

### *Stenothyra minima* (Sowerby).

1837. *Nematura minima*, Sowerby, *Charlesworth's Mag.* 1, p. 217, fig. 22 b, b.  
 1851. *Stenothyra minima*, Adams, *Proc. Zool. Soc. London*, p. 225

1856. *Stenothyra minima*, Benson, *op. cit.*, pp. 500, 501.  
 1858. *Stenothyra minima*, Adams, H. and A., *op. cit.*, p. 626.  
 1862. *Nematocera minima*, von Frauenfeld, *op. cit.*, p. 1160.  
 1870. *Stenothyra minima* (as *Nematocera* in *Syst. Ind.*), Hanley and Theobald, *op. cit.*, p. 17, pl. xxxvii, fig. 1.  
 1870. *Stenothyra minima*, Theobald, *op. cit.*, p. 15.  
 1885. *Stenothyra minima*, with var. *perobvia*, Nevill, *op. cit.*, p. 45.  
 1914. *Stenothyra orissaënsis*, Preston, *Rec. Ind. Mus.* X, pp. 300, 301, fig. 2.  
 1915. *Stenothyra orissaënsis*, *ib.*, *id.*, XI, p. 293.  
 1915. *Stenothyra orissaënsis*, *ib.*, *op. cit.*, p. 82.  
 1916. *Stenothyra orissaënsis* and *S. minima* (in pt.), Annandale and Kemp, *op. cit.*, p. 346.

Sowerby's description and figures of the type-shell of the species are very poor; Adam's and von Frauenfeld's descriptions also are no better; Benson's description, however, is excellent and Hanley and Theobald published a good figure.

Nevill gave the name *perobvia* to some specimens from Kathiawar, these specimens are subfossil, but do not materially differ from the large series from various places to deserve distinct varietal rank. We have not been able to trace the three specimens from Arakan, Burma, which Nevill referred to as "var. (? distinct sp.)."

Preston wrongly identified specimens of this species as belonging to a new species, which he described under the name *S. orissaënsis*, while the large series of specimens from the Chilka Lake which he named *S. minima* is a very mixed lot of specimens of *S. blanfordiana* and *S. (A.) miliacea*.

The specimens we now assign to this species are from the Little Rann of Cutch at Kura, Kathiawar; Bombay; Ceylon (types of the species labelled originally "*St. ceylonica*, n. sp. by Nevill) and the Chilka Lake, in which it is abundant in thickets of *Potamogeton pectinatus*.

### *Stenothyra woodmasoniana*, Nevill.

1880. *Stenothyra woodmasoniana*, Nevill, *op. cit.*, p. 159.  
 1881. *Stenothyra woodmasoniana*, Nevill, *op. cit.*, p. 150, pl. vii, fig. 8.  
 1885. *Stenothyra woodmasoniana*, Nevill, *op. cit.*, p. 40.  
 1915. *Stenothyra woodmasoniana*, Preston, *op. cit.*, pp. 81, 82.

Nevill's description and the notes appended to it together with the excellent figure in his second paper make the identification of this interesting species an easy matter.

The only specimens of the species in the collections of the Zoological Survey of India are the types and a series of co-types from Port Canning in the Gangetic Delta, but Nevill noted that the species was also represented in the collections of Dohrn, Beddome, Theobald, Blanford and Hungerford.

### *Stenothyra nana*, Nevill, MS. (Prashad).

Plate XVI, figs. 5, 6.

1885. *Stenothyra*, n. sp., Nevill, *op. cit.*, p. 43.

The shell of this species, as the name indicates, is very small, solid, rather opaque and yellowish brown in colour. The form is

subovoid, except that the body-whorl, in ventral view, is slightly angulate on the outer side. The apex in the unique type is eroded and appears bluntly rounded. There are only 4 whorls. The suture is faintly impressed, but regular and somewhat oblique. The whorls increase very rapidly; the first one is very minute, the second is much larger and only slightly swollen, the penultimate whorl is band shaped and moderately swollen. The body-whorl is large and in dorsal view sub-rhomboidal; in this view the right side is nearly straight to about half its length and then suddenly slopes down to the base, the opposite side is regularly curved except for a slight angulation about the middle. In ventral view the body-whorl is nearly flat in the anterior  $\frac{2}{3}$  of its length. The mouth is subcircular, rather small, being less than  $\frac{1}{3}$  of the size of the body-whorl; its margin is slightly reflected but does not project very much above the surface of the shell. The shell is not umbilicate, but has a very prominent boss as in the other species of the genus. Owing partially to erosion and partially to a deposit on the surface the sculpture is not clear all over the surface, but on certain parts of the penultimate whorl 6—7 spiral rows of punctured lines are distinctly to be made out.

*Measurements of type-shell* (in millimetres).

Length	..	..	..	2.2
Breadth of the body-whorl	..	..	..	1.9
Spire (dorsal view)	..	..	..	1.1
Aperture	..	..	..	.7

*Type-specimen*.—No. 2196 in the collections of the Zoological Survey of India (Indian Museum).

*Locality*.—A single specimen was collected by the late Mr. G. Nevill at Chandipal, Calcutta.

*Remarks*.—Nevill, in the paper cited above, did not give this species any name, nor did he publish a description of it; with the specimen, however, there is a label with the above name, which I have adopted.

The species belongs to the group of *S. deltae*, but differs in its very small size, in having a very short spire with a rounded apex and relatively larger aperture.

***Stenothyra deltae* (Benson).**

1836. *Nematura Deltae*, Benson, *Journ. As. Soc. Bengal*, V, p. 782.  
 1837. *Nematura Deltae*, Sowerby, *op. cit.*, pp. 216, 217, figs. a. a.  
 1856. *Stenothyra Deltae*, Benson, *op. cit.*, p. 499.  
 1857. *Nematura Deltae*, Troschel, *Gebiss der Schnecken* I, p. 104, pl. vii, fig. 11.  
 1858. *Nematura Deltae*, Adams, H. and A., *op. cit.*, I, p. 342, pl. xxxv, fig. 5, and II, p. 626.  
 1862. *Nematura deltae*, von Frauentfeld, *op. cit.*, p. 1159.  
 1865. *Stenothyra deltae*, Stimpson, *op. cit.*, p. 40.  
 1876. *Stenothyra Deltae*, (as *Nematura* in *Syst. Ind.*), Hanley and Theobald, *Conch Ind.*, p. 17, pl. xxxvii, fig. 2.

1876. *Stenothyra Deltæ*, Theobald, *op. cit.*, p. 15.  
 1888. *Stenothyra deltae*, with subvars. *minor* and *minima*, Nevill, *op. cit.*, p. 43.  
 1915. *Stenothyra deltae* with subvars. *minor* and *minima*, Preston, *op. cit.*, p. 79.

*S. deltae*, the type-species of the genus, has been described at length by a number of authors, we, however, think it necessary to note its distinctive characters once again:—The ventral surface of the body-whorl is flattened, and the shell is ornamented with spiral punctured lines; the mouth is very small, subcircular with merely the trace of a notch above; the peristome, though quite continuous, is very little raised above the surface of the body-whorl and, though not at all incrassate, hardly thinner than the shell immediately inside the lip. In

some specimens the periostracum is very thick and bears traces of spines arranged in spiral lines. They are probably present in the young.

The radula has been figured by Troschel.

We are not aware of the location of the types, but some of the specimens preserved in the collections of the Zoological Survey were presented by Benson. The species occurs far above the area of tidal influence in pure fresh water as well as in brackish water.

In the Indian Museum, it is represented

by specimens from Port Canning, Calcutta (Chandpal Ghat), Patna and Bhagalpur.



TEXT-FIG. 2.—*Stenothyra deltae* (Benson), side view of the shell to show the compressed nature of the same in the dorso-ventral.

### *Stenothyra foveolata*, Benson.

1856. *Stenothyra foveolata*, Benson, *op. cit.*, p. 497.  
 1858. *Stenothyra foveolata*, Adams, H. and A., *op. cit.*, p. 620.  
 1876. *Stenothyra foveolata* (as *Nematura* in *Syst. Ind.*), Hanley and Theobald, *op. cit.*, p. 17, pl. xxxvii, fig. 3.  
 1876. *Stenothyra foveolata*, Theobald, *op. cit.*, p. 15.  
 1858. *Stenothyra foveolata*, with var. *minor*, Nevill, *op. cit.*, p. 44.  
 1915. *Stenothyra foveolata* with var. *minor*, Preston, *op. cit.*, pp. 80, 81.

Benson described this species from a single specimen giving a full description but no figure. Hanley and Theobald, however, later figured the unique type. In the collections of the Indian Museum there is a single specimen collected at Sikrignalli by Dr. T. Oldham. Nevill considered it to belong to a new variety, which he named *minor*, but did not describe. We have compared the specimen with Benson's description and with Hanley and Theobald's figure and consider it to be an almost typical specimen of the species, differing from Benson's description only in being a little smaller and in the body-whorl being less swollen. Owing to erosion the sculpture unfortunately is not clearly to be made out.

These differences, in our opinion, are not sufficient for separating this single shell as a distinct species or variety.

As already noted the species is known only from a place at least 200 miles above the extreme tidal limit.

### *Stenothyra puncticulata* (Gould).

1847. *Nematura puncticulata*, Gould, *Proc. Boston Soc. Nat. Hist.* II, p. 220.

1876. *Stenothyra puncticulata*, Theobald, *op. cit.*, p. 15.

Gould described this species from specimens sent to him from Tavoy, Burma. He stated that the species was of the shape and size of *deltæ*, but had the aperture much more distorted; there was no umbilicus and the shell had a characteristic sculpture.

Nevill doubtfully considered it to be a synonym of *S. monilifera*. We have seen no specimens and it is not possible to be definite about it from the description only. We, therefore, hesitate in accepting Nevill's suggestion. Should, however, the two prove to be synonymous, then the name of the species must be *S. puncticulata* with *S. monilifera* as a synonym, and a new name will probably have to be given to *S. puncticulata*, Adams,<sup>1</sup> from the 'Eastern Islands.'

### Subgenus *Astenothyra*, nov.

1880. *Hydrobia* (*Belgrandia*), Nevill, *op. cit.*, p. 161.

1881. *Hydrobia* (*Belgrandia*), Nevill, *op. cit.*, p. 158.

1885. *Hydrobia* (*Bythinella*), in pt., Nevill, *op. cit.*, p. 49.

1915. *Bythinella*, Preston (*nec* Moquin-Tandon), *op. cit.*, p. 66.

1915. *Paludina* (*Belgrandia*), Preston (*nec* d'Orbigny and Bourguignat), *ib.*, *id.*, p. 67.

The shell is of more normal Hydrobiid facies in the dorsal and ventral aspects than in *Stenothyra* (s.s.); the surfaces of the body-whorl being convex, and the aperture being larger, slightly prominent and of ovate form. There is no definite triangular area between it and the outer edge of the body-whorl. The operculum naturally corresponds in outline with the aperture, but agrees in structure with that of *Stenothyra* (s.s.) and we have not discovered any difference in the radula or soft parts, except that the foot is not produced posteriorly.

*Type-species*.—*Hydrobia* (*Belgrandia*) *miliacea*, Nevill.

We recognize two species of this subgenus, (i) *A. miliacea* (Nevill), and (ii) *A. burmanica*, nov.; of the former we are able to distinguish three varieties (i) *forma typica*, (ii) var. *subangulata*, and (iii) var. *gibbosula*. These species and varieties may be distinguished with the help of the following key:—

- I. Shell elongate-conical, somewhat turreted with a very long spire and having a smooth shell ... .. *A. miliacea*.
- A. Body-whorl with a distinct keel ... .. var. *gibbosula*.
- B. Body-whorl smooth.
  - I. Aperture evenly rounded ... .. *forma typica*.
  - II. Aperture subangulate ... .. var. *subangulata*.

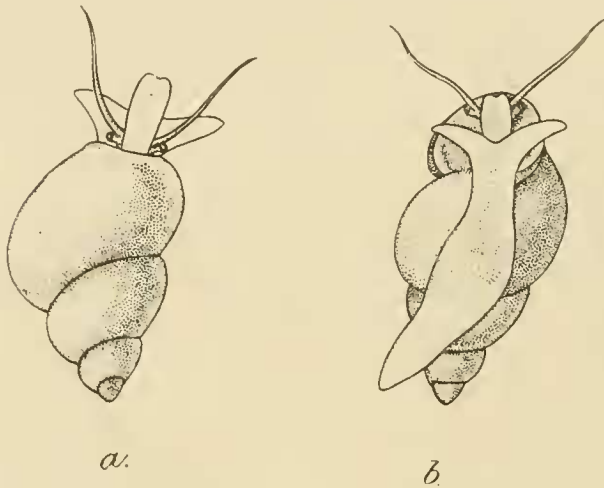
<sup>1</sup> Adams, *Proc. Zool Soc. London*, p. 226 (1851).

11. Shell ovate, not at all elongate, with a short spire and with a distinct pitted sculpture on its surface ... *A. burmanica*.

***Astenothyra miliacea* (Nevill).**

1880. *Hydrobia* (*Belgrandia*) *miliacea*, Nevill, *op. cit.*, p. 161  
 1881. *Hydrobia* (*Belgrandia*) *miliacea*, Nevill, *op. cit.*, p. 158, pl. vii, fig. 7.  
 1885. *Hydrobia* (*Bythinella*) *miliacea* and var. *minor*. Nevill, *op. cit.*, pp. 52, 53.  
 1915. *Paludestrina* (*Belgrandia*) *miliacea*, with var. *minor* Preston, *op. cit.*, pp. 67, 68.  
 1915. *Stenothyra trigona* (in part), Preston, *op. cit.*, p. 293, fig. 3.  
 1916. *Stenothyra trigona* (in part), Annandale and Kemp, *op. cit.*, p. 346.  
 1916. *Stenothyra perpumila* (in part), Preston, *Rec. Ind. Mus.* XII, p. 31, fig. 9.

We have nothing to add to Nevill's elaborate description of this species beyond the fact, that, in view of the large series of



TEXT-FIG. 3.—Animal of *S. (A.) miliacea* (Nevill).  
 (a) Dorsal view. (b) Ventral view.

shells now available, we consider his var. *minor* as a synonym of the same species, the types of his variety being only young shells. His figure of the type-shell is excellent and shows the diagnostic characters very well.

As has been stated already (p. 129) some of the shells identified by Preston as *Bythinella canningensis* belong to this species.

*Type-series*.—No. M 11865/2 in the collections of the Zoological Survey of India (Indian Museum).

Var. *gibbosula*, Nevill, MS. (Prashad).

Plate XVI, figs. 7, 8.

1885. *Hydrobia* (*Bythinella*) *miliacea* subvar. *gibbosula*, Nevill, *op. cit.*, p. 52.  
 1915. *Paludestrina* (*Belgrandia*) *miliacea* subvar. *gibbosula*, Preston, *op. cit.*, p. 67.

The unique type of this variety differs from the shells of the *forma typica* in (i) all the whorls of the spire and particularly the penultimate whorl being proportionately larger and more tumid, (ii) body-whorl a little smaller, but distinctly keeled, (iii) suture more deeply impressed and (iv) the peristome thicker owing to its margins being greatly retroverted.

*Type-specimen*.—No. M 11866/2 in the collections of the Zoological Survey of India (Indian Museum).

*Locality*.—A single shell was collected at Port Canning in the Gangetic Delta by the late Dr. F. Stoliczka.

*Remarks*.—This may possibly represent a distinct species, but we prefer to leave it as a variety of *A. miliacca* owing to there being a single specimen in which also the apex of the spire is eroded.

Var. *subangulata*, Nevill, MS. (Prashad).

Plate XVI, figs. 9, 10.

1885. *Hydrobia (Bythinella) miliacca* subvar. *subangulata*, Nevill, *op. cit.*, p. 52.

1915. *Paludestrina (Belgrandia) miliacca* subvar. *subangulata*, Preston, *op. cit.*, p. 68.

1910. *Stenothyra perpumila* (in part), Preston, *op. cit.*, p. 31.

This variety, which is fairly common at Port Canning and in the Chilka Lake, occurs at the former place with the *forma typica*. Specimens of it were found in the Cochin backwaters on the Malabar Coast by Dr. F. H. Gravely; they were identified as *S. perpumila* by Preston.

The variety differs from the typical form in having a proportionately smaller body-whorl and in the aperture being subangulate instead of the evenly rounded one of the typical form.

*Type-series*.—No. M 11867/2 in the collections of the Zoological Survey of India (Indian Museum).

*Astenothyra burmanica*, sp. nov. (Prashad).

Plate XVI, figs. 11, 12.

The shell of this species is minute and of a dirty creamy colour. It is ovate, and has a bluntly pointed apex. There are six whorls, and the suture is deeply impressed, somewhat canaliculate and only slightly oblique. The whorls increase gradually though a little irregularly; the first two are very minute, the third is a little more than half the breadth of the fourth, while the penultimate whorl is more than twice as broad as the fourth. The body-whorl is large, moderately inflated and, in dorsal view, somewhat trumpet-shaped. The mouth is oblique, ovate but acutely pointed posteriorly; the peristome is continuous and only slightly thickened with a rather broad callus. The entire surface of the shell is covered by spiral pitted lines; these are specially well marked on the body-whorl.

*Measurements of type-shell (in millimetres).*

Length of shell	..	..	..	1.5
Breadth of the body whorl	..	..	..	1.0
Length of spire	..	..	..	.8
Mouth	..	..	..	.5 × .4.

*Type-specimen.*—No. M 11868/2 in the collection of the Zoological Survey of India

*Locality.*—The unique type was collected by the late Dr. F. Stoliczka at Arakan, Burma.

*Remarks.*—The species comes near *A. miliacea* but has more whorls, is more compressed, shorter and has a different type of sculpture.